

## **Lunar Laser Ranging Session Summary**

Chair: Tom Murphy

The Lunar Laser Ranging (LLR) session consisted of a single presentation by T. Murphy about the new APOLLO LLR station. Despite this, the McDonald Laser Ranging Station (MLRS) is still actively engaged in LLR. The LLR station at the Grasse is undergoing a major renovation, which was reported by J. Torre in the *Telescopes, Stations, and Upgrades* session. LLR efforts continue at Matera and Mt. Stromlo, Matera having had some success in the past. There is interest in developing a new lunar-capable station in South Africa, though not presented at this conference. A campaign to perform one-way laser ranging to the Lunar Reconnaissance Orbiter (LRO) was discussed by M. Torrence and J. McGarry in the *Transponders* session.

The talk by Murphy, *APOLLO Springs to Life: One-millimeter LLR*, described the progress of the new LLR station at Apache Point in New Mexico. The station began lunar ranging operation in October 2005, attaining science-quality data beginning April 2006. APOLLO routinely achieves a large-enough photon count to achieve one-millimeter statistics. Peak rates approach one photon per pulse at 20 Hz, with ten-minute normal points sometimes consisting of several thousand photons. The 4×4 avalanche photodiode array and 16-channel timing system permits multi-photon returns, the strongest of which to date is 9 photons in a single pulse. Murphy also described the gravitational physics goals of APOLLO, revealing that LLR has already placed 0.1% limits on gravitomagnetism—the phenomenon behind Lense-Thirring precession.